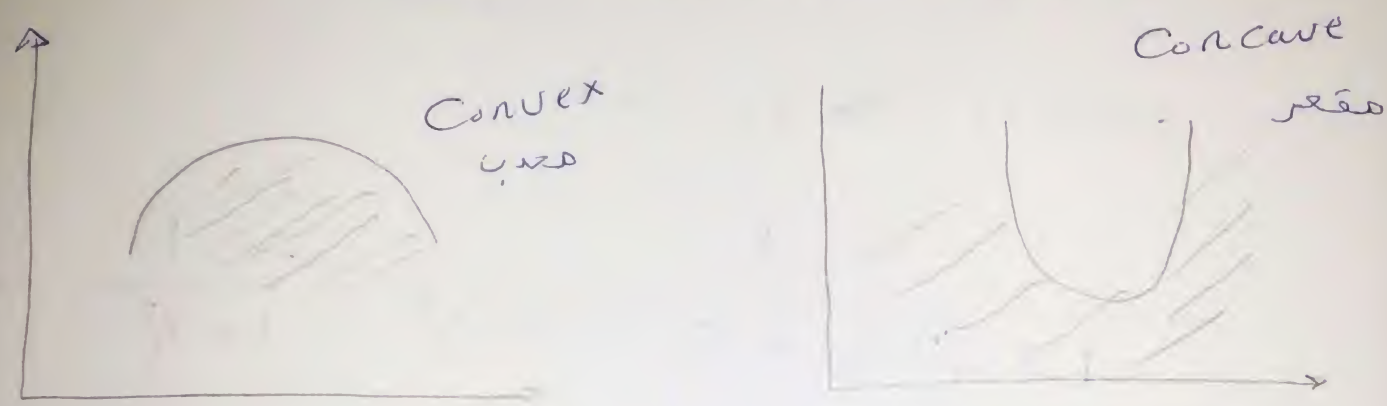
Math3b   سكشن 5   Fuzzy

— توجد مراجعة على السكشن السابق لكن لم ألحقها. ☹
sec 3

"Convex Fuzzy set"



— لو أخذت أى نقطتين على الدالة ووصلت بينهم بخط يكون داخل الدالة.

$$\boxed{\mu(\lambda x_1 + (1-\lambda)x_2) \geqslant \min(\mu x_1, \mu x_2)}$$

$\boxed{EX : 1}$ $\mu = \frac{1}{1+x^2}$

الحل

Let $\mu x_1 < \mu x_2$

$$R.H.S = \min(\mu x_1, \mu x_2) = \mu x_1 = \frac{1}{1-x_1^2} \longrightarrow (1)$$

$$L.H.S = \mu(\lambda x_1 + (1-\lambda)x_2)$$

$$= \frac{1}{1+(\lambda x_1 + (1-\lambda)x_2)^2}$$

replace ~~x_2~~ $x_2 \longrightarrow x_1$

$$= \frac{1}{1+(\lambda x_1 + x_1 - \lambda x_1)^2} = \frac{1}{1+x_1^2} \longrightarrow (2)$$

$L.H.S = R.H.S \Longrightarrow$ Convex #

$\boxed{ex2}$ $\mu = \begin{cases} 0 & x \leq 10 \\ \dfrac{1}{1+(x-10)^{-2}} & x > 10 \end{cases}$

Sol

at $\mu = 0$

$$\mu_{x_1} < \mu_{x_2}$$

$R.H.S = \min(\mu x_1, \mu y_2) = \mu x_1 \Rightarrow$

$L.H.S = \mu(\lambda x_1 + (1-\lambda)x_2) = 0 \longrightarrow$ Convex

for $\longrightarrow \mu = \dfrac{1}{1+(x-10)^{-2}}$

$\mu_{x_1} < \mu_{x_2}$

$R.H.S = \min(\mu_{x_1}, \mu_{x_2}) = \mu_{x_1} = \dfrac{1}{1+(x_1-10)^{-2}}$

$L.H.S = \mu(\lambda x_1 + (1-\lambda) x_2)$

$= \dfrac{1}{1+(\lambda x_1 + (1-\lambda) x_2 - 10)^{-2}}$ 　　 استبدال $x_2 \longrightarrow x_1$

$= \dfrac{1}{1+(x_1-10)^{-2}} = R.H.S \Rightarrow$ Convex

"Magnitude of fuzzy set"

$*$ Scaler ~~Cardinality~~ Cardinality $= |\tilde{A}| = \sum \mu$

$*$ relative Cardinality $= \|\tilde{A}\| = \dfrac{\sum \mu}{x}$

(a) $A = \{(x, 0.4), y(0.5), (z, 0.9), (w, 1)\}$

(b) $\tilde{B} = \{\frac{0.5}{u}, \frac{0.8}{v} + \frac{0.9}{w} + \frac{0.1}{x}\}$

(c) $\mu = \left(\frac{x}{x+1}\right)^2, \quad X = \{0, 1, 2, 3, \ldots, 10\}$

Solution

a)

$|\tilde{A}| = \sum \mu = 0.4 + 0.5 + 0.9 + 1 = 2.8$

$||\tilde{A}|| = \frac{2.8}{4} = 0.7$

b)

$|\tilde{B}| = \sum \mu = 0.5 + 0.8 + 0.9 + 0.1$

$||\tilde{B}|| = \frac{\sum \mu}{4} =$

c)

$\tilde{C} = \{\frac{0}{0} + \frac{0.25}{1} + \frac{0.44}{2} + \frac{0.56}{3} + \frac{0.64}{4}$

$+ \frac{0.7}{5} + \frac{0.73}{6} + \frac{0.77}{7} + \frac{0.8}{8} + \frac{0.81}{9} + \frac{0.83}{10}\}$

$|\tilde{C}| = \sum \mu = 6.53$

$||\tilde{C}|| = \frac{\sum \mu}{|x|} = 0.56$

$\boxed{4}$ sec5

"operations on fuzzy set"

$\boxed{1}$ Complement $\mu_{\bar{\tilde{A}}} = 1 - \mu_{\tilde{A}}$

$\boxed{2}$ union $\mu_{\tilde{A} \cup \tilde{B}} = \max(\mu_A, \mu_B)$

$\boxed{3}$ intersection $\mu_{\tilde{A} \cap \tilde{B}} = \min(\mu_A, \mu_B)$

← التعريفات دي وضعها لطفي زاده لكن فيه تعريفات بشكل آخر للجمس فقط دي لكننا بندرس دي عشان خاطر مصر -

$\boxed{4}$ $\tilde{A} - \tilde{B} = A \cap B^c$

$\tilde{B} - \tilde{A} = B - A^c$

$\boxed{5}$ $A \nabla B = (A - B) \cup (B - A)$

$\boxed{ex}$ $\tilde{A} = \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.5}{3} + \frac{0.9}{4}$

$\tilde{B} = \frac{0.4}{1} + \frac{0.2}{2} + \frac{0.6}{3} + \frac{0.8}{4}$

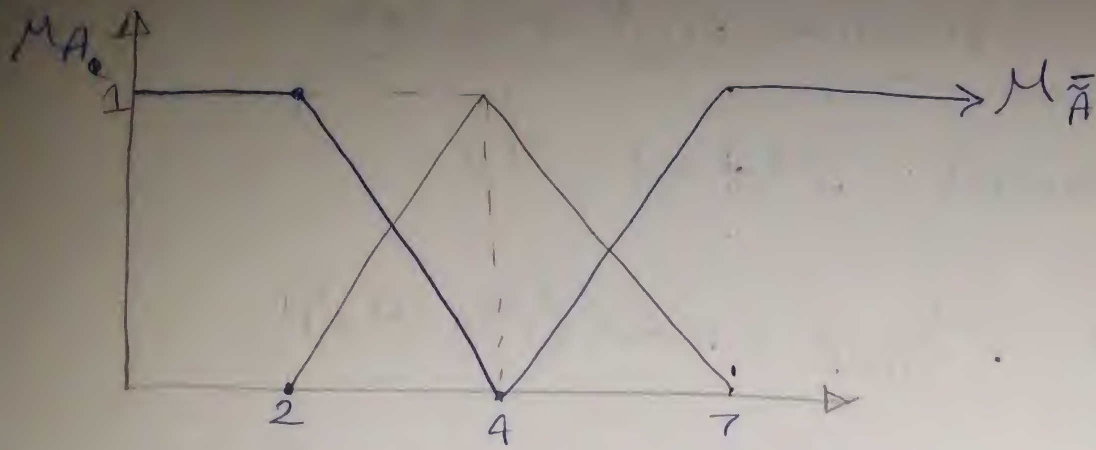
sol

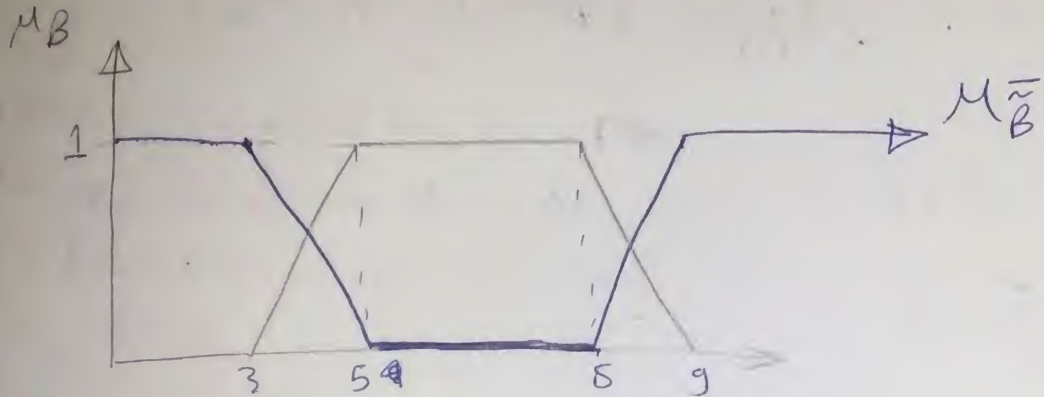
$\bar{\tilde{A}} = \frac{0.8}{1} + \frac{0.7}{2} + \frac{0.5}{3} + \frac{0.1}{4}$

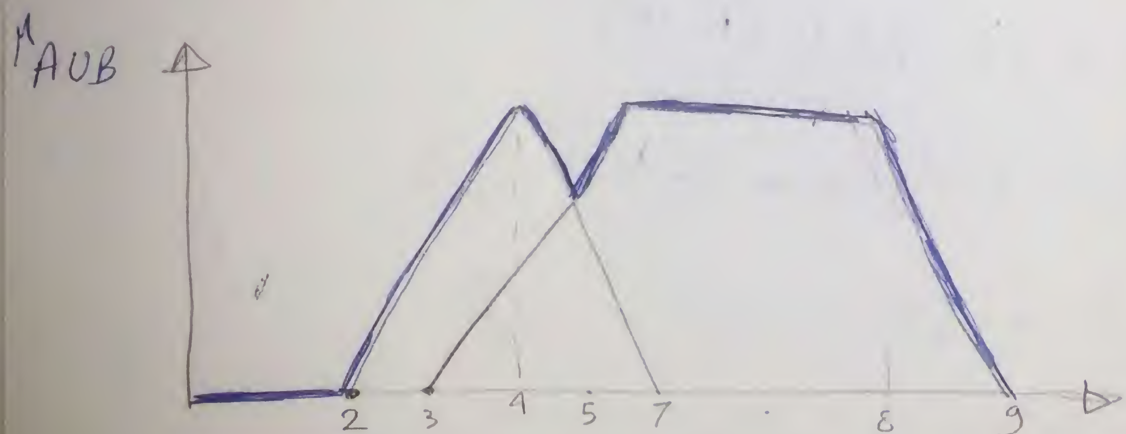
$\tilde{A} \cup \tilde{B} = \frac{0.4}{1} + \frac{0.3}{2} + \frac{0.6}{3} + \frac{0.9}{4}$

$\tilde{A} \cap \tilde{B} = \frac{0.2}{1} + \frac{0.2}{2} + \frac{0.5}{3} + \frac{0.8}{4}$

$\boxed{5}$ sec 5


μA
1
2
4
7
μ Ā


μB
1
3
5
8
9
μ B̄


μA∪B
2
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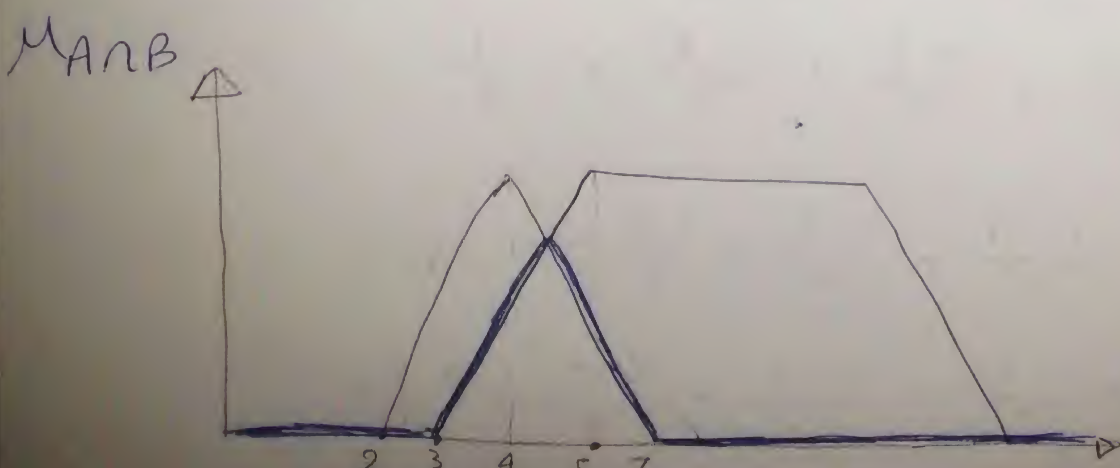

μA∩B
2
3
4
5
7

" مسائل من امتحانات سابقة "

* Consider the fuzzy set F & G defined in interval [0,10] by the membership

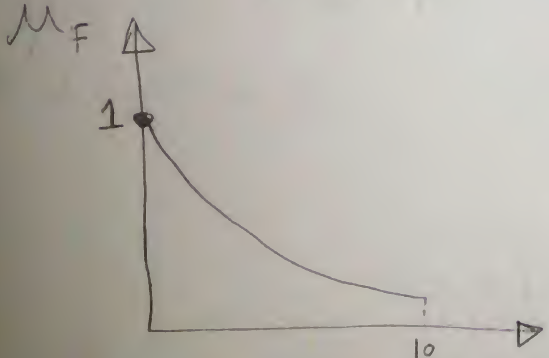
$\mu_F = 2^{-x}$, $\mu_G = \frac{1}{1-10(x-2)^2}$, Determine the mathematical formula and graphs of membership functions of

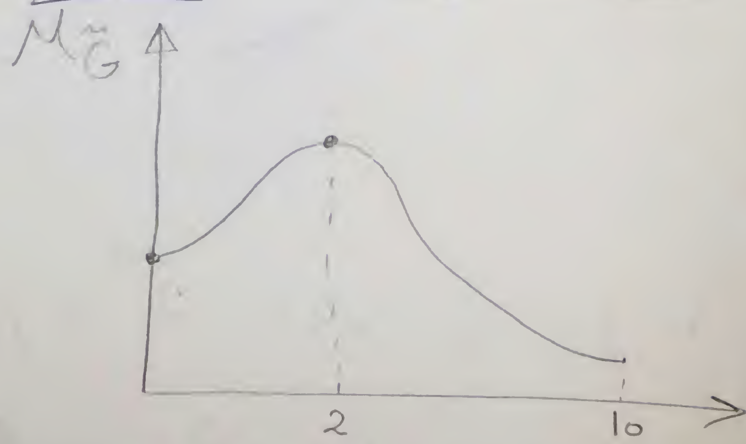
i) $\mu_{\bar{F}}$ & $\mu_{\bar{G}}$

ii) $\mu_{F \cup G}$ & $\mu_{F \cap G}$

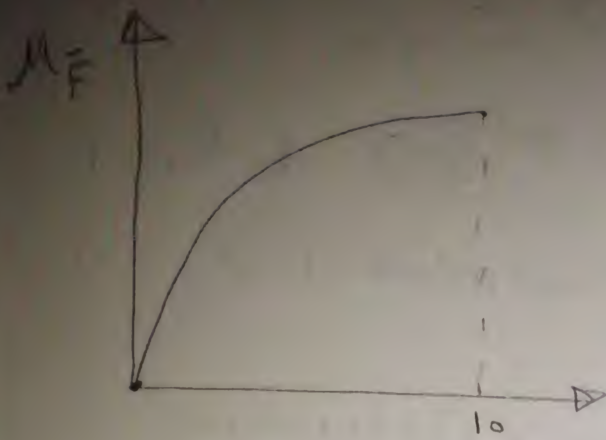
من امتحان العام الماضي

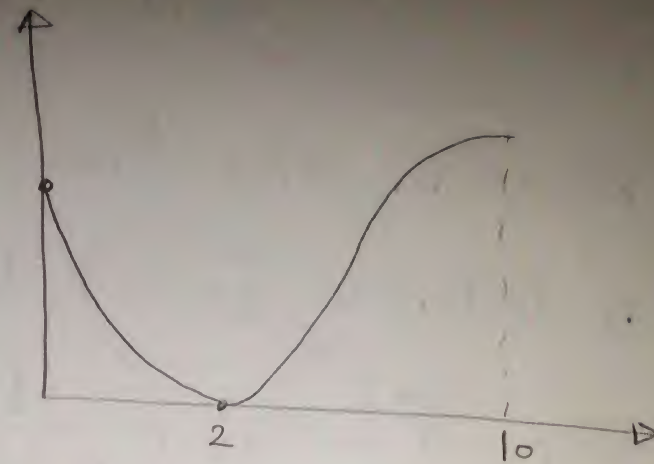
$\boxed{\text{Sol}}$





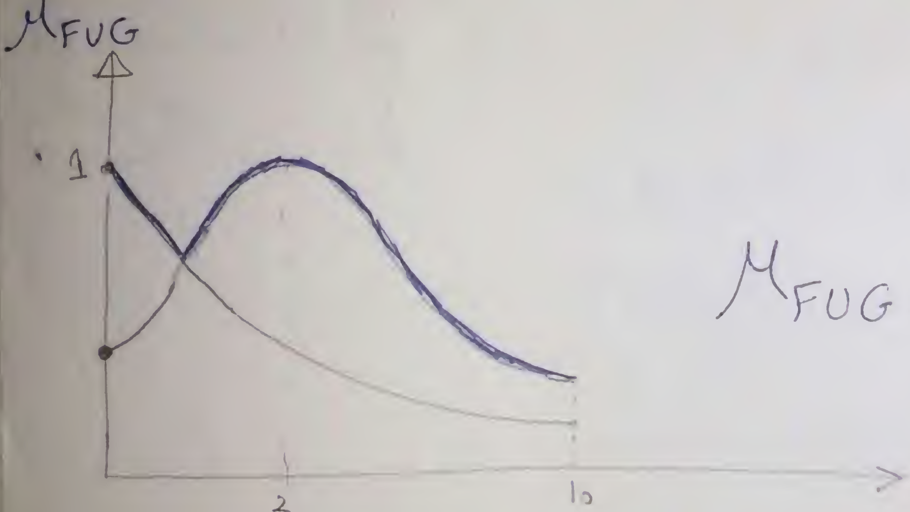
← احنا بنرسمهم في البداية.





$$\mu_{\bar{F}} = 1 - \mu_F$$
$$= 1 - 2^{-x}$$

$$\mu_{\bar{G}} = 1 - \mu_G$$
$$= 1 - \frac{1}{1+10(x-2)^2}$$



$$\mu_{F \cup G} = \begin{cases} 2^{-x} & 0 \leq x \leq a \\ \dfrac{1}{1+10(x-2)^2} & a \leq x \leq 10 \end{cases}$$

a ← قيمة مجهولة

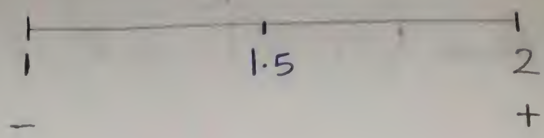
To get a Let $2^{-x} = \dfrac{1}{1+10(x-2)^2}$

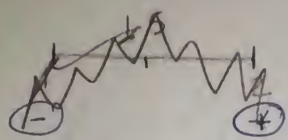
$$2^x = 1 + 10(x-2)^2 \Rightarrow f(x) = 2^x - 1 - 10(x-2)^2$$

← هنعوض عن x بقيم ولو الإشارة تغيرت هنعمل فترة ونقسمها . . . . .

$f(1) = -9$ $\ominus$

$f(2) = 3$ $\oplus$





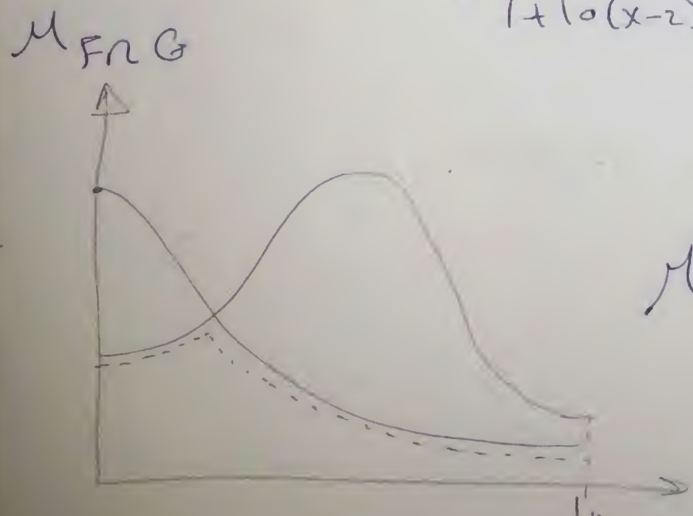
$f(1.5) = -ve$

ـــ نقسم الفترة ما بين 1.5 ، 2

$f(1.75) = +ve$

ـــ إذا نأخذ قيمة تقريبية ما بين 1.5 ، 1.75 فتكون
1.65

$$\mu_{F\cup G} = \begin{cases} 2^{x} & 0 \leq x \leq 1.65 \\ \dfrac{1}{1+10(x-2)^2} & 1.65 \leq x \leq 10 \end{cases}$$



$$\mu_{F\cap G} = \begin{cases} \dfrac{1}{1+10(x-2)^2} & 0 \leq x \leq 1.65 \\ 2^{-x} & 1.65 \leq x \leq 10 \end{cases}$$

* Show Demorgan's law using fuzzy set

$\boxed{1}$ $\cancel{A}$ $(A \cup B)^c = A^c \cap B^c$ ← complement

<u>Sol</u>

$$1 - \max(\mu_A, \mu_B) = \min(1 - \mu_A, 1 - \mu_B)$$

هذا المطلوب إثباته ←

<u>Let</u> $\mu_A < \mu_B$

$L.H.S = 1 - \max(\mu_A, \mu_B) = 1 - \mu_B$

$R.H.S = \min(1 - \mu_A, 1 - \mu_B)$

$-\mu_A > -\mu_B \Rightarrow 1 - \mu_A > 1 - \mu_B$

$R.H.S = 1 - \mu_B$ #

$\boxed{2}$ $(A \cap B)^c = A^c \cup B^c$

$$1 - \min(\mu_A, \mu_B) = \max(1-\mu_A, 1-\mu_B)$$

<u>Let</u> $\mu_A < \mu_B$

$L.H.S = 1 - \min(\mu_A, \mu_B) = 1 - \mu_A$

$R.H.S = \max(1-\mu_A, 1-\mu_B)$

$-\mu_A > -\mu_B \Rightarrow 1-\mu_A > 1-\mu_B$

$R.H.S = 1 - \mu_A$

$R.H.S = L.H.S$ ///

من أهم السكاشن جداً و هيجي كتير
منه في الإمتحان